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TENTATIVE DRAFT OF PROPOSED STANDARD SPECIFICATIONS FOR CAST IRON PIPE AND FITTINGS[1]

DESCRIPTION OF PIPE

SECTION 1. The pipes shall be made with *bell* and spigot *ends or with flange ends* and shall *conform accurately* to the dimensions given in Tables Nos........ and .... They shall be straight and shall be true circles in section, with their inner and outer surfaces concentric, and shall be of the specified dimensions in outside diameter.

Bell and spigot pipes shall be at least 12 feet in laying length, exclusive of the bell, and flange pipes shall be at least 12 feet in length face to face of flanges.

All classes of pipe of each size shall have the same outside diameter. All pipes having the same outside diameter shall have the same inside diameter at both ends.

The inside diameter of the lighter pipes of each standard outside diameter shall be gradually increased for a distance of about 6 inches from each end of the pipe barrel, so as to obtain the required standard thickness and weight for each size and class of pipe.

DESCRIPTION OF FITTINGS

SECTION 2. *There shall be two types of standard fittings, known as "Bell Fittings" and "Flange Fittings." Fittings having bell or spigot ends, or both, but no flange end or ends, shall be known as "Bell Fittings." Fittings having one or more flange ends shall be known as "Flange Fittings."*

All fittings shall be made in accordance with the cuts and dimensions given in the tables forming a part of these specifications. They shall be true circles in section with their inner and outer surfaces concentric

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[1] Submitted to the St. Louis convention May 15, 1918.

Changes from present New England and American specifications are **in italics.**

on both run and outlet, except where intersections prevent. On all fittings the outside diameter of the barrel on each outlet shall be the same as the outside diameter of the pipe of corresponding size.

For pipes from 4 to 20 inches in diameter, inclusive, one class of fittings known as Class D fittings shall be furnished for all classes of pipe. For pipes over 20 inches in diameter, two classes of fittings, known respectively as Class AB and CD fittings, shall be furnished, Class AB fittings for Class A and Class B pipes, and Class CD fittings or Class C and Class D pipes.

Any fitting not shown in the tables hereto attached shall be known as a "Special Fitting."

VARIATION IN DIAMETER OF BELLS AND SPIGOTS

SECTION 3. Especial care shall be taken to have the *bells* and spigots of the required size. The *bells* and spigots will be tested by circular gages, and no pipe or *fitting* will be accepted *which, for any cause, does not comply with the specified joint space, except as hereinafter allowed.*

The inside diameters of the bells and the outside diameters of the spigot ends of pipes shall not vary from the standard dimensions by more than 0.06 inch for pipes 16 inches or less in diameter; 0.08 inch for pipes 18, 20 and 24 inches in diameter; 0.10 inch for pipes 30, 36 and 42 inches in diameter; 0.13 inch for pipes 48, 54 and 60 inches in diameter; *and 0.18 inch for pipes 72 and 84 inches in diameter.*

The inside diameters of the bells and the outside diameters of the spigot ends of the fittings shall not vary from the standard dimensions by more than 0.08 inch for fittings 16 inches or less in diameter; 0.10 inch for 18-, 20-, and 24-inch fittings; 0.13 inch for 30-, 36-, and 42-inch fittings; 0.16 inch for 48-, 54- and 60-inch fittings; and 0.20 inch for 72- and 84- inch fittings.

VARIATION IN THICKNESS

SECTION 4. For pipes whose standard thickness is less than 1 inch the thickness of metal in the body of the pipe *shall not vary more than 0.08 inch* from the standard thickness, and for pipes whose standard thickness is 1 inch or more, the variation shall not exceed 0.10 inch., except that for spaces *the length across which in* *any direction does not exceed 8 inches, a decreased thickness not exceeding 0.02 inch will be permitted, and for spaces the length across which does not exceed 16 inches in any direction, an increased thickness not exceeding 0.05 inch will be permitted*—both in excess of the allowances above stated.

For fittings, a variation 50 per cent greater than that allowed for pipes shall be permitted.

ALLOWABLE PERCENTAGE OF VARIATION IN WEIGHT

SECTION 5. No pipe shall be accepted, the weight of which shall be less than the standard weight by more than 5 per cent for pipes 16 inches or less in diameter and 4 per cent, for pipes more than 16 inches in diameter, and no excess above the standard weight of more than the above given percentages for the several sizes shall be paid for. The total weight of pipe to be paid for shall not exceed, for each size and class of pipe received, the sum of the standard weights of the same number of pieces of the given sizes and classes by more than 2 per cent.

No *fitting* shall be accepted, the weight of which shall be less than the standard by more than 10 per cent for *fittings* 12 inches or less in diameter and 8 per cent for larger sizes (except that curves and Y-branches may be 12 per cent below the standard weight); no excess above the standard weight of more than the above given percentages for the several sizes shall be paid for. *The total weight of fittings to be paid for shall not exceed the sum of the standard weights of the same number of pieces of the given sizes and classes by more than 5 per cent.*

QUALITY OF IRON

SECTION 6. All pipes and fittings shall be made of cast iron of good quality and of such character as shall make the metal of the casting strong, tough, and of even grain, and soft enough satisfactorily to admit of drilling and cutting. The metal shall be made without *the admixture of any inferior material*, and shall be remelted in cupola or air furnace.

The contractor shall furnish the engineer with copies of the mill analyses of each heat or run of metal, and shall furnish samples to the engineer for check analyses when required.

The metal for the pipes and fittings shall fulfil the following chemical requirements: Total carbon, 3 to 3.75 per cent; combined carbon, 0.5 to 0.75; silicon, 1.6 to 2; manganese, 0.35 to 0.55; phosphorus, not to exceed 0.90; sulphur, not to exceed 0.10 per cent.

TESTS OF MATERIAL

SECTION 7. Specimen bars of the metal used, each being 26 inches long by 2 inches wide and one inch thick, shall be made, without charge, as often as the engineer may direct, and in default of definite instructions the contractor shall make and test at least one bar from each heat or run of metal. The bars, when placed flatwise upon supports 24 inches apart and loaded in the center, shall support a load of 2000 pounds, and show a deflection of not less than *0.32 inch before breaking, and an increase in deflection of not less than 0.03 inch for each 200 pounds of ultimate breaking load in excess of 2000 pounds.*

The contractor shall have the right to make and break three bars from each heat or run of metal, and the test shall be based upon the average results of the three bars. Should the dimensions of the bars differ from those above given, a proper allowance therefor shall be made in the results of the tests.

CASTING OF PIPE

SECTION 8. The pipes shall be cast in dry sand molds in a vertical position. Pipes 16 inches or less in diameter *may* be cast with the *bell* end up or down, unless *otherwise* specified *by the purchaser.* Pipes 18 inches or more in diameter shall be cast with the bell end down.

The pipes shall not be stripped or taken from the pit while showing color of heat, but shall be left in the flasks for a sufficient length of time to prevent contraction by subsequent exposure.

QUALITY OF CASTINGS

SECTION 9. The pipes and fittings shall be smooth, free from scales, lumps, blisters, sand holes and defects of every nature which, in the opinion of the engineer, unfit them for the use for which they are intended. No plugging or filling will be allowed.

MARKING

SECTION 10. *Each* pipe and *fitting* shall have distinctly cast upon it the initials of the maker's name, a *letter designating the class to which the casting belongs, and figures showing the year in which it was cast. When cast to order, if required by the purchaser, each pipe and fitting 6 inches or more in diameter shall also have cast upon it a serial number, designating the order in point of time in which it was cast, the serial number to be placed below the date, thus:*

1916	1916	1916
1	2	3

etc., and any initials, not exceeding four, *or a symbol,* which may be required.

The letters and figures shall be cast on the outside, and shall *be not* less than 2 inches in length and $\frac{1}{8}$ inch in relief for pipes *and fittings 10 inches* in diameter and larger. For smaller sizes of pipe, the letters may be 1 inch in length. The weight, *serial number,* and class letter shall be conspicuously painted in white on the inside of each pipe and *fitting* after the coating has become hard.

DEFECTIVE SPIGOT ENDS MAY BE CUT

SECTION 11. Defective spigot ends on pipes 12 inches or more in diameter may be cut off in a lathe, and half-round wrought-iron or *mild-steel* band, shrunk into a groove, cut at the end of the pipe. Not more than 12 per cent of the total number of accepted pipes of each size shall be cut and banded, and no pipe shall be banded which is less than 11 feet in length, exclusive of socket.

Pipes may be cast with shrink-head above spigot bead, and such pipe shall not be considered as cut pipe in determining the percentage above referred to.

In case the length of pipe differs from 12 feet, the standard weight of the pipe given in Table shall be modified in accordance therewith.

FLANGES

SECTION 12. *Flanges shall be cast solid and shall be accurately faced smooth and true. Holes for bolts or studs shall be drilled, and the flanges shall be tapered where required. The contractor shall furnish and deliver all bolts and nuts for bolting on manhole covers. The* *bolts and nuts shall be of the best-quality wrought iron or mild steel, with good, sound, well-fitting threads, the nuts to be cold punched. The heads and nuts shall be hexagonal and shall be trimmed and chamfered. The heads, nuts and threads shall be of the United States Standard sizes.*

CLEANING AND INSPECTION

SECTION 13. All pipes and *fittings* shall be thoroughly cleaned and subjected to a careful hammer inspection. No casting shall be coated unless entirely clean and free from rust, and approved in these respects by the *engineer* immediately before being *coated.*

COATING

SECTION 14. Every pipe and *fitting* shall be coated inside and out with coal-tar pitch varnish. *Each pipe and fitting shall be heated to a uniform temperature of 320° F., in a suitable oven, before it is dipped, and the material in the tank shall also be maintained at this temperature, and each pipe and fitting shall be kept in the bath for at least five minutes, during which time the temperature of all parts of the bath, including the bottom, shall be as specified.*

After removing the pipe from the bath, it shall be suspended or set in a vertical position until the coating has solidified.

The coating shall be of pitch, made from coal tar, distilled until the naphtha is removed, and sufficient oil to make a smooth coating, tough, elastic, strongly adhesive to the metal, tough and tenacious when cold, and not brittle nor with any tendency to scale off. Coating shall not be soft enough to flow when exposed to summer heat, nor brittle enough to crack and scale when exposed to a temperature below freezing.

The pitch shall be straight-run, coal-tar pitch, which shall soften at 60°F. and melt at 100°F., being a grade in which distillate oils, distilled therefrom, shall have a specific gravity of 1.05. The pitch shall not contain less than 10 per cent nor more than 18 per cent of free carbon.

Fresh pitch and oil shall be added to the tank when necessary to keep the mixture of the proper consistency. The oil used for this purpose shall consist of heavy, coal-tar oil, with a specific gravity of not less than 1.04 at 60°F., and which shall not lose more than 5 per cent of oil when distilled up to 400°F.; not more than 40 per cent of oil when *distilled up to 450°F. If the material in the tank thickens or deteriorates when used, the tank shall be emptied of its contents and refilled with fresh material when deemed necessary by the engineer.*

Fittings which are too large to be immersed shall be coated with hot varnish by hand, the fittings to be heated as specified above and the coating applied immediately thereafter.

Faces of flanges and finished surfaces shall be coated with a mixture of grease and white lead immediately after they have been faced and drilled.

Any pipe or *fitting* that is to be recoated shall first be thoroughly scraped and cleaned.

HYDROSTATIC TEST

SECTION 15. When the coating has become hard, the pipe shall be subjected to a proof by hydrostatic pressure, and if required by the engineer, they shall also be subjected to a hammer test under this pressure.

The pressures to which the different sizes and classes of pipe shall be subjected are as follows:

CLASS	HYDROSTATIC PRESSURE POUNDS PER SQUARE INCH	
	Diameter less than 20 inches	Diameter 20 inches and ver
A	300	150
B	300	200
C	300	250
D	300	300

The full hydrostatic pressure shall be applied to the pipes for one minute on pipes 12 inches and less diameter; for two minutes on 14-, 16-, 18-, 20- and 24-inch pipes; for three minutes on 36-inch pipes; and for five minutes on pipes larger than 36 inches in diameter.

Fittings shall also be subjected to a proof by hydrostatic pressure, provided the same is specified in the contract. If tested, the hydrostatic pressures to which the fittings shall be subjected shall be the same as those to which pipes of the same size and class would be subjected and shall be applied for the same length of time.

WEIGHING

SECTION 16. The pipes and *fittings* shall be weighed for payment under the supervision of the engineer after *they have been coated.* If desired by the purchaser, the pipes and *fittings* shall be weighed after their delivery. The weight so ascertained shall be used in the final settlement, provided such weighing is done by a legalized weigh master. *The cost of weighing after delivery shall be borne by the purchaser.*

Bids shall be submitted and final settlement made upon the basis of a ton of 2000 pounds.

CONTRACTOR TO FURNISH MEN AND MATERIAL

SECTION 17. The *contractor* shall provide all tools, testing machines, materials and men necessary for the required testing, inspection and weighing at the foundry of the pipes and *fittings*, and should the purchaser have no inspector at the *foundry*, the contractor shall, if required by the purchaser, furnish a sworn statement that all of the tests have been made as specified, this statement to contain the results of *the chemical and physical tests.*

POWER TO INSPECT

SECTION 18. The engineer shall be at liberty at all times to inspect the material at the foundry and the molding, casting and coating of the pipes and *fittings.* The forms, sizes, uniformity and conditions of all pipes and *fittings* herein referred to shall be subject to his inspection and approval, and he may reject, without proving, any pipe or *fitting* which is not in conformity with the specifications or drawings furnished.

INSPECTOR TO REPORT

SECTION 19. The inspector at the foundry shall report daily to the contractor all pipes and *fittings rejected,* with the causes for rejection.

CASTINGS TO BE DELIVERED SOUND AND PERFECT

SECTION 20. All pipes and *fittings shall* be delivered in all respects sound and conformable to these specifications. The inspection shall not relieve the contractor of any of his obligations in this respect, and defective pipes or *fittings* which may have passed the engineer at the foundry or elsewhere shall be at all times liable to rejection, when discovered, until the final completion and adjustment of the contract, provided, however, that the contractor shall not be held liable for pipes or *fittings* found to be cracked after they have been accepted at the agreed point of delivery. Care shall be taken in handling the pipes *and fittings* not to injure the coating, and no pipes, *fittings* or other material of any kind shall be placed in the pipes or *fittings* during transportation *or at* any time after they have *been coated.*

The contractor shall not be held responsible for any expenses or damages incurred in handling or using the castings after they have been accepted at the agreed point of delivery. Any pipe or fitting that proves defective shall, when requested, be replaced by the contractor, the measure of the damage not to exceed the value of the casting found defective. The contractor shall have the right to call for the defective casting to be returned to him at the agreed point of delivery before any allowance for the same is demanded.

DEFINITION OF THE WORD "ENGINEER"

SECTION 21. Wherever the word "engineer" is used herein, it shall be understood to mean the engineer or inspector acting for the purchaser, and his properly authorized agents, limited by the particular duties intrusted to them.